

RISK



ESC Cost Core Training

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**Module
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What Is Risk?

Risk

- a hazard; a factor or course involving uncertain danger



Uncertainty

- not reliable; not known beyond doubt ;
problematic; not clearly identified or defined

4 Main Sources of Cost Estimate Risk

1. Technical Inputs
2. Schedule Inputs
3. Cost Methodology & historical cost data inputs
4. Ground Rules and Assumptions

Sources of Risk

Example

Estimating Software: You are told \$150 per LOC and there are 50,000 LOC. That is half of what is needed but the other 50,000 already exists.

50,000 lines of code is a **technical parameter** from a functional specialist who decided it is a cost driving parameter.

The methodology is **Factors** - the factor being \$150 per LOC.

Driving Factors of Risks Associated With Technical/Schedule Inputs

- Program phase (EMD, Prod, O&S, etc)
- Maturity of program definition
- Stability of requirements prior to contract award
- System complexity
- Source of technical/schedule inputs
- Risk-reducing initiatives
- History of similar programs

Frequent Risk Assessment Problems

- Assuming a technical or schedule input is solid can result in cost optimism, not cost realism.
- Most ground-rules and assumptions are not that solid.
- Assessing the risk associated with inputs and assumptions is the responsibility of the cost estimating team.

Risk Assessment Components

- Sensitivity Analysis
- Risk Analysis
- ECO Analysis

Sensitivity Analysis

- Measure how sensitive system cost/schedule is to variations in input parameters
 - as any parameter is varied, the analyst observes the impact on cost and schedule
- Should also be performed on any significant ground rules and assumptions
- Can be performed on the estimated labor rate

Risk Analysis Techniques

- Request a range, not a point value, from the functional specialists for significant input parameters so that the degree of uncertainty in those values is apparent.
- Obtain a second opinion on a significant input parameter from an independent specialist.
- Using the “Push to Test” technique to understand how certain the input parameter is.

Traditional Technique for Risk Analysis

- Risk models, based on Monte Carlo simulations, that output Cum Frequency Distributions can be used to assess risk.
- Use of such a model results in a distribution of random total costs which can be described by a mean and a standard deviation.

Proposed Approach at ESC

- Ask functional specialists for most likely range for each key technical and schedule input.
- Base the Program Budget point estimate on the upper end of the most likely range.
- Define and calculate risk dollars as the difference between the high and midpoint values of the most likely range provided by the specialists.

Advantages to the Most-Likely Range Approach

- Most likely range instills more confidence in the estimate because the most likely scenario has been dealt with, not the most optimistic or worse case scenarios.
- Functional specialists do not easily think in terms of extremes.
- Extreme values do not facilitate the definition of the program baseline and associated parameters.
- Program risk dollars, now associated with discrete elements of cost, are discretely defined and substantiated.

ECO Analysis



Another component of risk assessment is an evaluation of potential contract changes and the associated impact on cost that needs to be included in the estimate.



Potential Contract Changes

Estimate how much needs to be added to the Program cost to accommodate potential changes to the contract. Several factors:

- Program phase
- Program stability
- Program history

How to Estimate Remaining ECOs on an On-Going Contract

- Calculate the actual dollar value of total ECOs to date.
- Ask the PM and specialists which ECPs already submitted are most likely to be negotiated and added to contract as ECOs. Out of those, develop cost estimates for any significant dollar ones.
- Add cost of actual ECOs to date (Step 1) to estimated cost from Step 2, and compute as % of Original Target Cost.
- Discuss program stability on this contract.
- Get PM's & specialists' best estimate of "Remaining ECOs not yet identified as % of original target cost".
- Remaining ECOs = cost estimate from Step 2 + estimated cost for future ECOs (i.e. % from Step 5 x Original Target Cost).
- Compute the Total ECOs at completion as a percentage of Contract's Original Target Cost.

How to Estimate ECOs on Analogous Programs

ECO experience of analogous programs:

Current Target Cost - Original Target Cost =
Contract Cost Growth

Contract Cost Growth - New Requirements
(PMD directed) - Options Exercised =
ECOs

Convey Program Uncertainties & Associated Cost Ranges to Decision-Makers

- When functional specialists are very unsure about a parameter run a sensitivity study.
- When you show decision-makers that a particular assumption drives much of the cost, they start to pay attention.
- When you draw attention to a parameter, functional specialists may finally answer your questions.